

A PRELIMINARY STUDY OF THE GENUS *STYLOPS*
IN CALIFORNIA (PART I)

(Strepsiptera, Stylopidae)

BY RICHARD M. BOHART

University of California, Davis

Genus *Stylops* Kirby

Stylops Kirby, 1802, Monographia Apum Angliæ, vol. 2.

Stylops Saunders, 1872, Trans. Ent. Soc. Lond., pp. 1-48.

Stylops Pierce, 1909, U. S. Nat. Mus., Bull. 66.

Neostylops Pierce, 1918, U. S. Nat. Mus., Proc. vol. 54.

Since the publication of several papers on Strepsiptera by W. D. Pierce, the taxonomy of the North American members of this interesting group of insects has been neglected. In the present paper an attempt is made to bring more nearly up to date one of the larger genera, *Stylops*.

The prominent generic characters of *Stylops* are: in the male, six-segmented antennæ with the third segment produced, four-segmented clawless tarsi, a large postlumbium, and a scutellum which is at least as long as the prescutum; in the female, five genital tubes, and a brood passage which extends to the sides of the head or almost so; and in the triungulinid, three ocelli, a body clothed with spines of two sizes, and two apical stylets.

Pierce, 1918, erected the genus *Neostylops* for species in which the scutellum does not separate the scutæ. Although of excellent specific value, this character is so completely unsupported by other distinctions in either sex that in the writer's opinion it is not deserving of generic rank.

In the matter of host specificity the writer has found that in many cases *Stylops* are parasitic upon two or more similar species of *Andrena*.

The worker in Strepsiptera is confronted with the great difficulty of obtaining material. Particularly is this true of the males, which furnish the best diagnostic characters. Females may be taken in considerable numbers by assiduous collecting but have relatively few specific characters. In the past three years the writer has been fortunate enough to examine about thirty male *Stylops* of half a dozen different species. The most definite and constant structure is the ædeagus which should be

removed and mounted on a slide for microscopic study. In addition the relative lengths of the six antennal segments and the shape of the metathoracic parts are of great determinative value.

The specific differences of female *Stylops* lie in the shape of the cephalothorax including its relative measurements, the mandibles, the shape of the basal band, and the general markings. Each of these is unfortunately subject to variation, and as a result, most species can be properly characterized only from a series of specimens.

A key to the males is given in the present paper which includes four new species. In a later paper (Part 2) a number of additional species will be described and a key to the females will be presented.

Types and paratypes are to be deposited in the California Academy of Sciences from which a number of Stylopized *Andrena* have been borrowed for study.

To date the male *Stylops* of only four species have been described from North America. Two of these, *childreni* Gray¹ and *solidulæ* Pierce² are unsatisfactorily described. Hence they are not included in the following key.

PARTIAL KEY TO THE MALES OF THE GENUS *STYLOPS*
IN NORTH AMERICA

1. Scutellum reaching almost to the prescutum..... 2
- ... Scutellum with its anterior margin distinct, not reaching almost to the prescutum, but leaving a definite and depressed bridge between the scutæ..... 4
2. Apical process of ædeagus relatively long and slender; scutellum roughly wedge-shaped, not depressed or pedunculate anteriorly *cuneiformis* Bohart
- ... Apical process of ædeagus relatively short and stout; scutellum pedunculate and strongly depressed anteriorly..... 3
3. Species very stout..... *timberlakei* Bohart
- ... Species slender..... *pacificus* Bohart
4. Prescutum about as long as the scutellum, broadly and sharply truncate behind..... *shannoni* Pierce
- ... Prescutum distinctly shorter than the scutellum..... 5
5. Apical margin of ædeagus less than one-half the length of the main axis; fourth antennal segment only slightly shorter than

¹ 1832, Cuvier's Animal Kingdom, Griffith edn., XV (Insects Vol. 2), p. 684, pl. 59.

² 1909, U. S. Natl. Mus., Bul. 66, p. 107.

- the fifth and sixth together..... *medionitans* Pierce
 ... Apical margin of ædeagus two-thirds the length of the main axis; apical process very long, slender, and tapering; fourth antennal segment distinctly shorter than the fifth and sixth together 6
 6. Fourth antennal segment shorter than the sixth; ædeagus narrowly incised behind the process..... *vandykei* Bohart
 ... Fourth antennal segment longer than the sixth; ædeagus not so incised..... *crawfordi* Pierce

Stylops vandykei Bohart, new species

(Figs. 7, 11, 14, 18, and 21)

This species is remarkable for its large size, particularly in the female, which may attain a length of nine mm. and a spiracular breadth of one and three-quarters mm. In the male the sixth antennal segment is longer than either the fourth or fifth. The scutæ are broadly connected and the scutellum is broadly flattened dorsally. The process of the ædeagus is elongate. The female possesses a prominent basal mandibular tubercle, a general convexity of cephalothoracic outline, and a straight anterior margin of the basal band.

Vandykei is the largest species of the genus thus far described. An extensive series of females has been studied and considerable variation exists in the size of the cephalothorax depending upon the size of the host.

Dr. E. C. Van Dyke collected the species many years ago in Berkeley and I take pleasure in naming it in his honor.

Male. Black, wing veins and abdomen fuscous, tibiæ and tarsi testaceous, wings milky. Head small, strongly depressed medially; eyes relatively small; mandibles slightly curved, obtusely pointed; antennal segments three to six with the length ratio 83:41:30:50 respectively. Metathorax consisting dorsally of two raised areas separated in the middle by the depressed postlumbium, compressed strongly at the sides in front of and behind the postlumbium; metaprepectum dorsally flattened and almost quadrangular; scutæ broadly connected by a depressed median area; scutellum large, flattened dorsally, and broadly rounded anteriorly; postlumbium almost triangular, about as wide as long; hypoepimera large, rounded laterally and flattened dorsally. Ædeagus bent at an acute angle, apical process very long, apical margin of ædeagus two-thirds the length of the main axis. Length excluding antennæ, 3.7 mm.; length of antennæ, 0.81 mm.; width of head, 0.82 mm.; length of elytra, 0.45 mm.; wing expanse, 7.7 mm.

Male puparium cap. Antennæ represented by a pair of oval rings separated from each other by three times their breadth; mandibles separated by twice their breadth; maxillæ separated by less than their breadth; eye sockets small, separated by three times their breadth.

Female. Cephalothorax almost evenly ferrugino-testaceous except for the fuscous basal band. Cephalothorax about as long as broad, apex rounded, lateral margins convex, slightly irregular and constricted at the base of the molars; base of head not broad (0.61 times width at spiracles), mouth hemispherical, each mandible with a stout blunt apical tooth and a prominent basal tubercle on the outer edge below the middle, mandible incurved between outer apex and basal tubercle; spiracles small and exceeding the margins; basal band short, three times as wide as long, straight along the anterior margin.¹ Width of cephalothorax at spiracles, 1.58 mm.; width at base of mandibles, 0.60 mm.; width at base of head, 0.97 mm.; width at base of cephalothorax, 1.27 mm.; length from front edge of spiracles to apex, 1.11 mm.; length of cephalothorax, 1.56 mm.

Triungulinid. Body oblong-ovate, widest at the middle; length of body excluding stylets, 0.247 mm.; length of stylets, 0.152 mm.; width of head, 0.049 mm.

Holotype. Male, Berkeley, California, March 12, 1935. Allotype. Female, Berkeley, California, February 11, 1934. Paratypes, two males and eight females. All type material collected in Berkeley by G. E. Bohart and the author.

Host. *Andrena perimelas* Ckll. (Berkeley) and *Andrena carliniformis* Ckll. (Klamath Lake, Oregon), (det. by P. H. Timberlake). *Perimelas* has been taken on both *Brassica* and *Ranunculus*.

Occurrence in California. The only Californian records are from the San Francisco Bay region where it occurs from the middle of February to the middle of April. Triungulinids appear upon the bees about the first of April.

STYLOPS MEDIONITANS Pierce

(Figs. 4, 8, 13, 17, and 19)

Stylops medionitans Pierce, 1918, Proc. U. S. Nat. Mus. Vol. 54, p. 450

This species has not been heretofore figured and the male is undescribed. The characteristic features in the male are the broadly connected scutæ, the relative lengths of the antennal

¹Measurements adopted from Pierce, 1918, Proc. U. S. Nat. Mus. Vol. 54.

segments, and particularly the form of the ædeagus. The cephalothorax of the female is broad and blunt, typically rounded apically, and with the lateral margins straight for some distance behind the marginal spiracles. The mandibles are incurved below the outer apex.

Male. Black, abdomen fuscous, tarsi light, head broad; eyes large; antennal segments three to six with the length ratio 50:29:-15:19 respectively; second maxillary segment sharply pointed and almost as long as antennal segments three and four together. Prothorax half as wide as the head. Metaprescutum slightly wider than long, broadly rounded apically, distinctly separated from the prescutum by a depressed scutal area; postlumbium rounded behind, as wide as long; postscutellum about as wide as the rest of the metathorax. Ædeagus bent at right angles, with a moderately long, very slender process, which is curved at the base and produced backwards as a small distinct inner process. Length excluding antennæ, 3.07 mm.; length of antennæ, 0.69 mm.; width of head, 0.77 mm.; wing expanse, 5.9 mm.

Male puparium cap. Antennæ and maxillæ each represented by a pair of oval rings separated by three times their breadth, mandibles separated by twice their breadth, eye sockets large, separated by slightly more than two and one-half times their breadth.

Female. The following is quoted from the original description of Pierce: "Cephalothorax yellowish brown with dark basal band; rather broad and rounded; strongly constricted at the base; spiracles marginal, not prominent; mandibles dentate at the apex, strongly rounded at the outer apical angle and angulate on the side." From a study of a long series of specimens the following may be added. The cephalothorax is shovel-shaped in outline, being rather broadly rounded at the apex and sharply angled in back of the spiracles. The lateral margin is usually irregular. The mandibles are always at least slightly incurved below the outer apex and each typically bears a small stout apical tooth. The front margin of the basal band is straight or wavy, never convex. The spiracles are often large but flattened close to the margin, hence not prominent. The width at the spiracles averages about 0.85 mm.

Triungulinid. Not heretofore described. Length of body excluding stylets, 0.192 mm.; length of stylets, 0.08 mm.; width of head, 0.037 mm.

Host. *Andrena medionitens* Ckll. (det. by P. H. Timberlake), which is the type host as recorded by Pierce, and two other unidentified species.

Occurrence in California. The range probably covers the entire northern half of the state; records are from Tulare, Monterey,

San Mateo, Alameda, Sonoma, Nevada, Plumas, Mendocino, Trinity, and Humboldt counties from April to July. The only previous record is that of the type specimen which was taken June 24 at Florissant, Colorado.

Stylops timberlakei Bohart, new species

(Figs. 2, 6, 10, 16, and 22)

The male of this species is notable for its robust appearance, separated scutæ, pedunculate scutellum, and the peculiar form of its ædeagus. The important features of the female are the usually angled lateral margins, the rather even coloration, the irregular but not convex anterior margin of the basal band, the marginal spiracles, and the angulate mandibles which are incurved below the outer apex. The species is named in honor of Mr. P. H. Timberlake, who collected the type series and determined most of the *Andrena* hosts recorded in this paper.

Male. Black, abdomen fuscous, tarsi pale. Antennal segments three to six with the length ratio 49:29:15:16 respectively; mandibles apically enlarged and beveled. Prothorax half as wide as the head. Prescutum slightly broader than long, pentagonal, broadly truncate behind; scutellum anteriorly indistinctly margined, pedunculate, depressed, and completely separating the scutæ; postlumbium broadly rounded behind, broader than long; postscutellum longer than the rest of the metathorax. Ædeagus bent at an acute angle with a relatively short stout process. Length excluding the antennæ, 3.5 mm.; length of antennæ, 0.95 mm.; width of head, 0.95 mm.; wing expanse, 6.8 mm.

Male puparium cap. Antennæ separated by three times their breadth, eye sockets by three times their breadth, mandibles by one and one-half times their breadth, and maxillæ by almost twice their breadth.

Female. Cephalothorax ferrugino-testaceous, lighter toward the center in head and thoracic regions; basal band fusco-piceous. Cephalothorax about as broad as long, narrowly truncate, lateral margins angled at the base of the head and indented in front of the spiracles. Head medium broad at the base (.64 times the width at spiracles), mouth oblong-ovate, mandibles angled with an incurve below the outer apex, apical tooth stout and sharply pointed, basal tubercle wanting; spiracles exceeding the lateral margins but not prominent; basal band relatively narrow, slightly wavy along the anterior margin but not definitely convex. Width of cephalothorax, 1.0 mm.; width at base of mandibles, 0.41 mm.; width at base of head, 0.64 mm; width at base of cephalothorax,

0.75 mm.; length from front edge of spiracles to apex, 0.66 mm.; length of cephalothorax, 1.0 mm.

Holotype, male, Riverside, California, March 2, 1929. Allotype, female, Riverside, California, March 13, 1930. Paratypes, three females, Riverside, California. All type material was collected by Mr. P. H. Timberlake.

Host. *Andrena macrocephala* Ckll. (det. by P. H. Timberlake) on *Nemophila*.

Stylops pacificus Bohart, new species

(Figs. 1, 5, 9, 15, and 20)

The outstanding characteristics of *pacificus* are in the male; the slender form, the pedunculate scutellum which almost completely separates the scutæ, the long slender postscutellum, and the peculiar form of the ædeagus. The female can be separated from *californica* Pierce by its more narrow truncation, from *advarians* Pierce by the convex anterior margin of the basal band (not invariable), and from both of the above by the less prominent spiracles. Furthermore, it can be distinguished from *subcandidæ* Pierce and *timberlakei* by its spade-shaped cephalothorax and usually blunt mandibular tooth. The triungulinid is peculiar in having stylets only one-fifth as long as the rest of the body.

Male. Black, tarsi fuscous, wings milky with fuscous veins, abdominal segments whitish at the sides; body slender. Head large, more than twice as wide as long; eyes large; antennal segments three to six with the length ratio 83:44:26:29 respectively; mandibles slightly enlarged and beveled at the tips; second maxillary segment large, broad at the middle and beveled sharply to a point at the apex. Prothorax half as wide as the head. Metathorax very long, compressed laterally in front of and behind the postlumbium; prescutum about as long as broad, roughly five-sided; scutæ separated by deep sutures from the prescutum and by ridges from the postlumbium and postscutellum; scutellum slender, strongly convex posteriorly, depressed and very narrow in front, almost completely separating the scutæ; postlumbium rounded, about as wide as long; postscutellum slender, half the length of the entire metathorax, strongly convex posteriorly; hypœpimera flattened dorsally and separated from the postscutellum by deep sutures. Ædeagus bent at right angles, with a short, relatively stout apical

process. Length excluding the antennæ, 2.75 mm.; length of antennæ, 0.75 mm.; width of head, 0.85 mm.; wing expanse, 5.8 mm.

Male puparium cap. Antennæ and maxillæ each indicated by a pair of oval rings separated from each other by three times their breadth, mandibles separated by twice their breadth, eye sockets large, and separated from each other by twice their breadth.

Female. Cephalothorax ferrugino-testaceous at the sides, lighter at the center, the spiracular area shaded with minute fuliginous specks on a clear background, basal band fusco-piceous. Cephalothorax about as long as broad, truncation moderate in width and rounded at the edges, lateral margins indented in front of the spiracles, straight from spiracles to apex. Head medium broad at the base (0.66 times width at spiracles), mouth elliptical, mandibles with apical tooth small and blunt, basal tubercle lacking, outer margin rounded; spiracles exceeding the margins but not prominent; basal band with the anterior margin convex. Width of cephalothorax, 0.86 mm.; width at base of mandibles, 0.38 mm.; width at base of head, 0.57 mm.; width at base of cephalothorax, 0.66 mm.; length from front edge of spiracles to apex, 0.55 mm.; length of cephalothorax, 0.88 mm.

Triungulinid. Body long oval, stylets very short. Length of body excluding stylets, 0.163 mm.; length of stylets, 0.035 mm.; width of head, 0.034 mm.

Holotype, male, Berkeley, California, March 1, 1934. Allotype, female, Berkeley, California, March 19, 1935. Paratypes, three males and six females. All type material was collected in Berkeley by G. E. Bohart and the author.

Host. *Andrena complexa* Sm. (det. by P. H. Timberlake) and *Andrena* sp. undetermined, on *Ranunculus*.

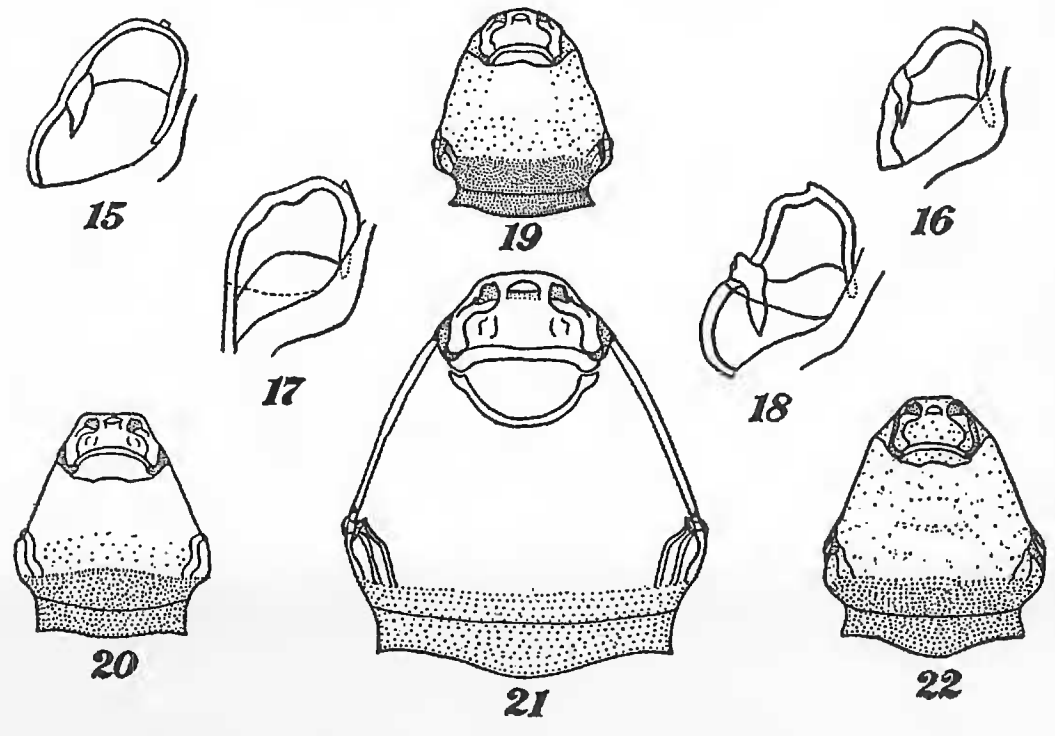
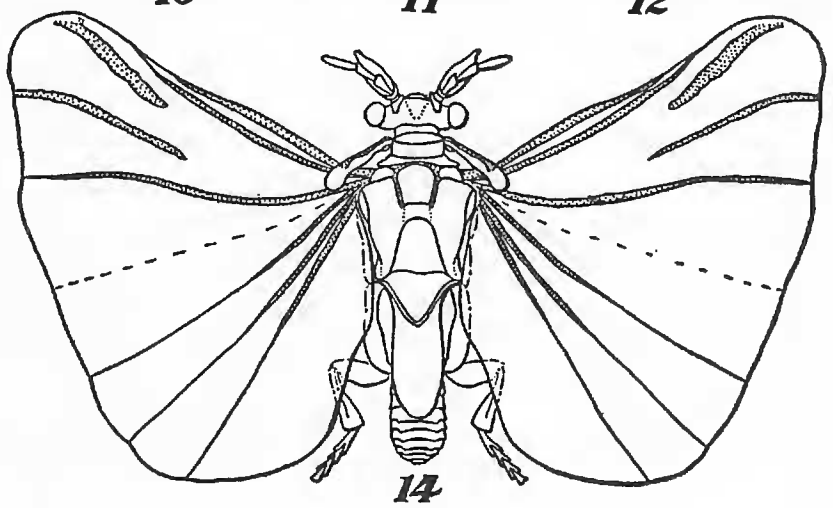
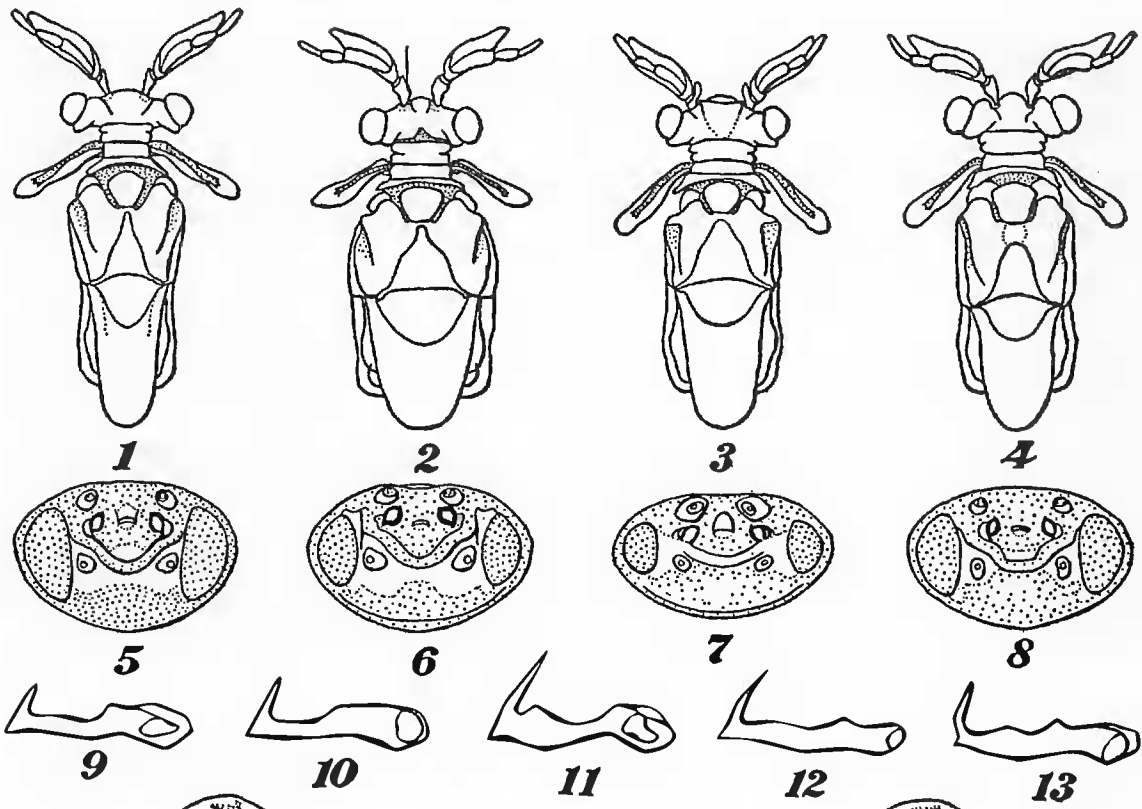
Occurrence in California: *Pacificus* probably occurs over a large portion of the state as records are from Alameda, Sonoma, Trinity, Calaveras, and Modoc counties.

Stylops cuneiformis Bohart, new species

(Figs. 8 and 12)

The species is characterized by the wedge-shaped male scutellum from which its name is derived, by the separated scutæ, and by the slender curved apical process of the ædeagus. The female is unknown. The writer is indebted to the California Academy of Sciences for the loan of the type specimens.

Male. Head, prothorax, mesothorax, and scutellum of metathorax black., otherwise fuscous except for the milky hind wings and pale tarsi. Head broad, strongly depressed medially; eyes



large; antennal segments three to six with the length ratio 56:28:13:21 respectively; mandibles very long and slender. Prothorax half as wide as the head. Metaprescutum flattened dorsally and longer than wide (foreshortened in figure); scutellum wedge-shaped, flattened dorsally, only slightly depressed anteriorly, and almost completely separating the scutæ; scutæ strongly depressed at the sides; postlumbium wider than long, broadly rounded behind; postscutellum longer than the rest of the metathorax. Ædeagus bent at an acute angle with a slender curved apical process, apical margin of ædeagus about two-thirds the length of the main axis. Length excluding the antennæ, 2.5 mm.; length of antennæ, 0.61 mm.; width of head, 0.76 mm.; wing expanse, 6.5 mm.

Holotype, male, Coronado, California, March 1, 1891 (F. E. Blaisdell collector). Paratype, one male, same data as holotype.

Host. *Andrena* species undetermined.

Fig. 1. *Stylops pacificus*, male. (Hind wings and abdomen not shown.) Fig. 2. *Stylops timberlakei*, male. Fig. 3. *Stylops cuneiformis*, male. Fig. 4. *Stylops medionitans*, male. Fig. 5. *Stylops pacificus*, male puparium cap (end view). Fig. 6. *Stylops timberlakei*, male puparium cap. Fig. 7. *Stylops vandykei*, male puparium cap. Fig. 8. *Stylops medionitans*, male puparium cap. Fig. 9. *Stylops pacificus*, ædeagus. Fig. 10. *Stylops timberlakei*, ædeagus. Fig. 11. *Stylops vandykei*, ædeagus. Fig. 12. *Stylops cuneiformis*, ædeagus. Fig. 13. *Stylops medionitans*, ædeagus. Fig. 14. *Stylops vandykei*, male. Fig. 15. *Stylops pacificus*, female mandible. Fig. 16. *Stylops timberlakei*, female mandible. Fig. 17. *Stylops medionitans*, female mandible. Fig. 18. *Stylops vandykei*, female mandible. Fig. 19. *Stylops medionitans*, female cephalothorax. Fig. 20. *Stylops pacificus*, female cephalothorax. Fig. 21. *Stylops vandykei*, female cephalothorax. Fig. 22. *Stylops timberlakei*, female cephalothorax.

SAY'S PLANT BUG, CHLOROCHROA SAYI STAL., ON
BEETS IN CALIFORNIA

According to the literature to date Say's plant bug, *Chlorochroa sayi* Stal., has not been recorded on beets. Several specimens of this species were collected at Hemet, California, June 19, 1935, on beet plants that were being grown for seed. At the time the specimens were collected the beet seeds or kernels had apparently attained the maximum size, although they had not hardened sufficiently to harvest. The brood of adult bugs had infested the beet plants too late in the season to cause any apparent damage to the developing kernels.—H. L. McKenzie.